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(71) Applicant *(for all designated States except US)*: **ATTEXOR EQUIPEMENTS S.A.** [CH/CH]; Chemin des Larges Pieces, CH-1024 Ecublens (CH).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **DUBUGNON, Olivier** [CH/CH]; CH-1115 Vullierens (CH).

(74) Agent: **JOHANSSON, Lars**; Patech Sarl, Case postale 25, CH-1138 Villars-sous-Yens (CH).

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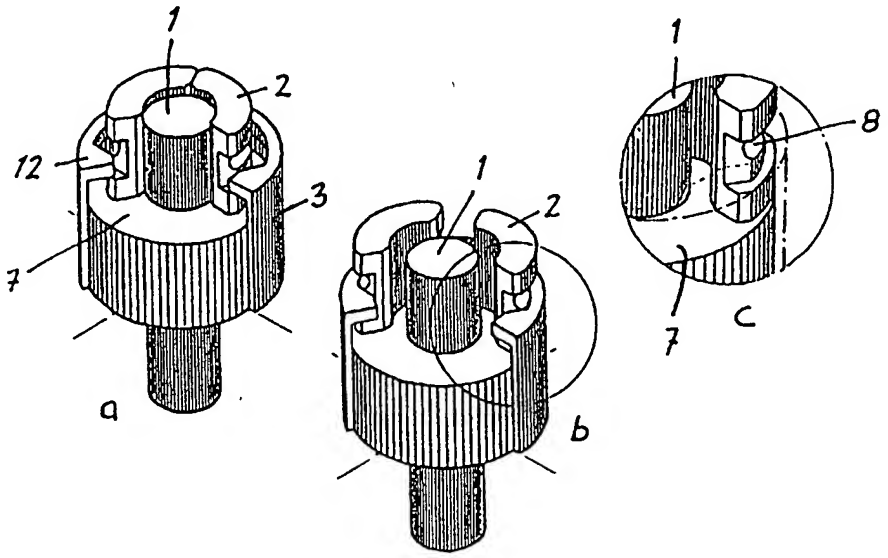
(54) Title: A TOOL FOR JOINING TWO OR SEVERAL OVERLAYING SHEET FORMED MEMBERS



(57) Abstract: A tool for joining two or several sheet formed members, comprising a first tool-part with a punch and a second tool-part provided with a support surface (7) from which an anvil (1) erects. A matrix comprising at least two matrix-parts (2) being arranged around said anvil (1), each matrix-part (2) comprising a foot arranged sliding against said support surface (7) and being applied against the lateral surface of said anvil (1) by means of elastic means (5). A stop means (3) limiting the lateral displacement of the is also arranged. The stop means is characterised in that it has a top surface (12) provided with at least two guiding slots (9) for the matrix-parts (2) with edges (10) parallel to a radius of said second tool-part.

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A TOOL FOR JOINING TWO OR SEVERAL OVERLAYING SHEET FORMED MEMBERS

Technical field

This invention relates to a tool for joining two or several overlaying sheet formed members, metal or non-metal.

Background art

From the prior art tools are known for making joints between sheet material, comprising a first tool-part with a punch and a sometimes a so called side pressing element and a second tool-part provided with a support surface from which an anvil erects. A matrix comprising at least two matrix-parts is arranged around said anvil, each matrix-part comprising a foot arranged sliding against said support surface. The matrix parts are being applied against the lateral surface of said anvil by means of some elastic means. The elastic means could have the form of a ring made of an elastomer surrounding the matrix-parts.

Means for limiting the lateral displacement of the matrix-parts is also provided. Said stop means could e.g. have the form of a cage fixed on and surrounding said second tool-part. This cage also has the function of stopping the vertical movement of the matrix parts especially when the punch and the joint are retracted from the matrix at the end of the joint forming procedure.

This type of tools are generally used in a method of the single stroke type which means that the whole procedure of making the joint takes place during one

single relative movement between the first and second tool parts i.e. the punch and the co-acting die or matrix.

For the compression of the bottom wall at the end of the stroke the anvil is co-acting with the punch.

Brief description of the invention

A primary object of the present invention is to give the possibility to reduce the total diameter of the second tool-part keeping the strength of the tool, essentially of the matrix elements.

The present invention, which provides a solution to the said technical problem is characterised according to the appended claims.

Brief description of the figures

Other objects, uses and advantages of this invention will be apparent from the reading of this description which proceeds with reference to the accompanying drawings forming part thereof and wherein:

Figure 1 shows in section a second tool part according to the prior art.

Figures 2a to 2c show in perspective and partly in section a second tool part according to the invention.

Figures 3a and b show in perspective a second tool part according to the invention without the cage.

Figure 4a shows in perspective a cage and an anvil.

Figure 4b shows in perspective a matrix part.

Figure 5 shows a top view of a second tool part according to the invention indicating the movement of one matrix part.

Detailed description of the invention

The following description of the invention will concentrate on the second tool part, i.e. the matrix-anvil combination. As punches and sidepressing elements according to prior art could be used together with the second tool part according to the invention the detailed description of these parts will be left out here.

Figure 1 shows in section a second tool part according to the prior art. A fixed cage 3 is surrounding the anvil portion 1. The thickness (in the radial direction) of the vertical wall of the cage is designated c. The diameter of the anvil 1 is 2f. The thickness of the matrix part in the radial direction in the section is designated a. The lateral expansion of the die is 2b.

An overlapping e between the cage and the matrix parts have to be arranged so that the matrix parts will be blocked for vertical movement in both rest position and expanded position.

Thus, the total diameter of the second tool part will be 2(f+a+2b+e+c).

In a practical example the initial opening of the die has e.g. a diameter of 5 mm which means that f equals 2.5 mm. During the formation of the joint the lateral

expansion will be let say 2 mm so that the opening before retraction of the joint will have a diameter of 7 mm. In that case the measure b has to be 1 mm plus a smaller security margin. Thus the measure b is imposed by the joint to make.

The measure f is a fixed value. The overlapping e is for security reasons also a more or less fixed value. This means that if one wishes to reduce the total diameter of the tool according to the prior art it is only possible to decrease the measures a and c. Now, there will be a problem because both these measures are critical when it comes to the strength of the matrix part.

The inventive idea is directed to a solution eliminating the overlap e in the radial direction in a way which will create considerable advantages and open new design possibilities.

By giving the upper part of the cage and the side portions of the matrix parts a special form described more in detail below the necessary overlapping has been moved to the side portions of the matrix parts. This means that the width h of the part 6 of the foot of the matrix part 2 in figure 1 can be reduced. Theoretically the portion 6 can be eliminated because it has no function according to the invention in the creation of the overlap.

Thus, the total diameter of the tool according to the invention will be 2(f+a+b+c).

Thus, an application of the inventive idea opens the possibility to increase the thickness c of the cage wall and/or the thickness a of the matrix parts thereby increasing the strength and lifetime of the tool. The tools will be less brittle. The created margins could of course instead be used for the design of a tool with a decreased overall diameter. Any combinations of these two effects could of course also be achieved so that you get a stronger tool with a smaller diameter.

As a secondary effect the matrix parts can also be made more compact in the vertical direction. Additionally the matrix parts will be blocked from rotation around the anvil 1 due to the new arrangement of the overlapping.

When the dimension in the radial direction of the portion 6 of the foot of the matrix parts 2 according to figure 1 is decreased or when the portion 6 is completely eliminated there will of course be an increased tendency of the matrix part to tilt when forces are applied in the vertical direction during the formation of the joint. This tendency is balanced by the guiding effect of the upper part of the cage according to the invention.

One advantage with the invention is that the matrix parts can be designed with smaller dimensions in the vertical direction. Another advantage is that there will be no rotation of the matrix parts around the anvil part. Additionally the tool can be used closer to edges and angles on the workpiece or more generally can be used in positions where prior art tools can not work. The tilting of the matrix parts can be avoided. The tool will have a better over all stability.

Figures 2a to 2c show in perspective and partly in section a second tool part according to the invention. The anvil 1 is surrounded by the support surface 7. As according to the prior art a cage 3 is used as stop means and to block the vertical movement of the matrix parts 2. Each matrix part is provided with a groove 8 for the surrounding elastic element 5, cf. figure 3a.

Figures 3a and b show in perspective a second tool part according to the invention without the cage 3. Figure 3a shows the rest position for the matrix parts around the anvil 1. Figure 3b shows the second tool part in its expanded position. Each matrix part 8 is provided with sideways protruding portions 11 co-operating with edges 10 in a guiding slot 9 for each matrix part 2 arranged in the horizontal top surface 12 of the cage 3, cf. figures 4 and 5.

Figure 4a and b shows in perspective a cage 3 and an anvil 1. The horizontal top surface 12 of the cage 3 has in this case been provided with three guiding slots 9, one for each of three matrix parts 2. It should be noted that in principle there could be two, three or more slots and matrix parts according to the invention. The co-operation between the sideways protruding portions 11 of the matrix parts and the edges 10 in the guiding slot 9 will guide the movement of the matrix part in the radial direction of the tool part. It will also block any rotation of the matrix parts around the anvil 1, and finally it will create the necessary overlapping between the cage and the matrix part blocking the vertical movement of the matrix part which is especially important at the end of the joint forming process.

Figure 5 shows a top view of a second tool part according to the invention indicating the movement of one matrix part. It can be seen that the overlapping is effective during the full movement.

Claims

1. Tool for joining two or several sheet formed members, comprising a first tool-part with a punch and a second tool-part provided with a support surface (7) from which an anvil (1) erects, a matrix comprising at least two matrix-parts (2) being arranged around said anvil (1), each matrix-part (2) comprising a foot arranged sliding against said support surface (7) and being applied against the lateral surface of said anvil (1) by means of elastic means (5), stop means (3) limiting the lateral displacement of the matrix-parts (2) characterised in that the stop means has a top surface (12) provided with at least two guiding slots (9) with edges (10) parallel to a radius of said second tool-part.

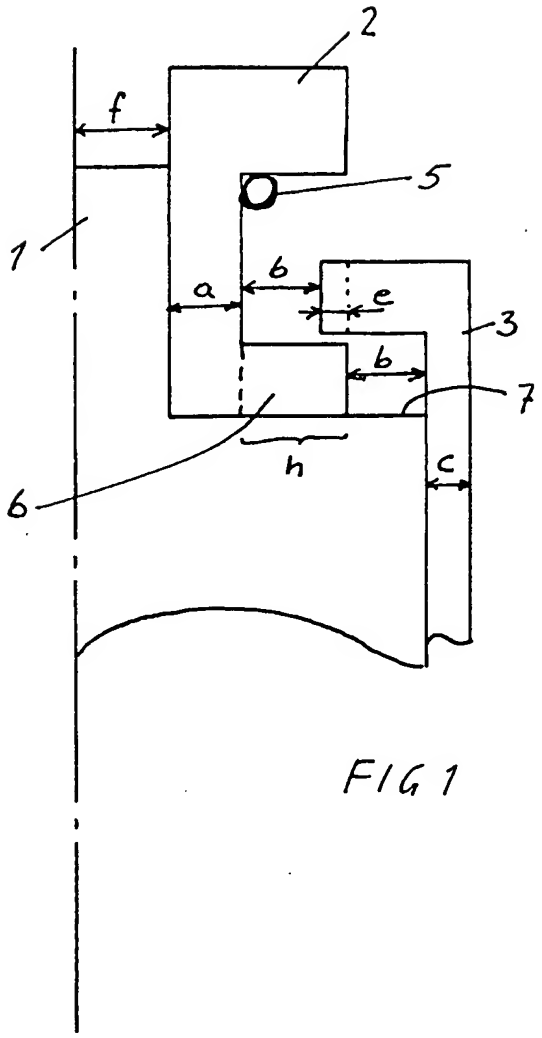

FIG 1

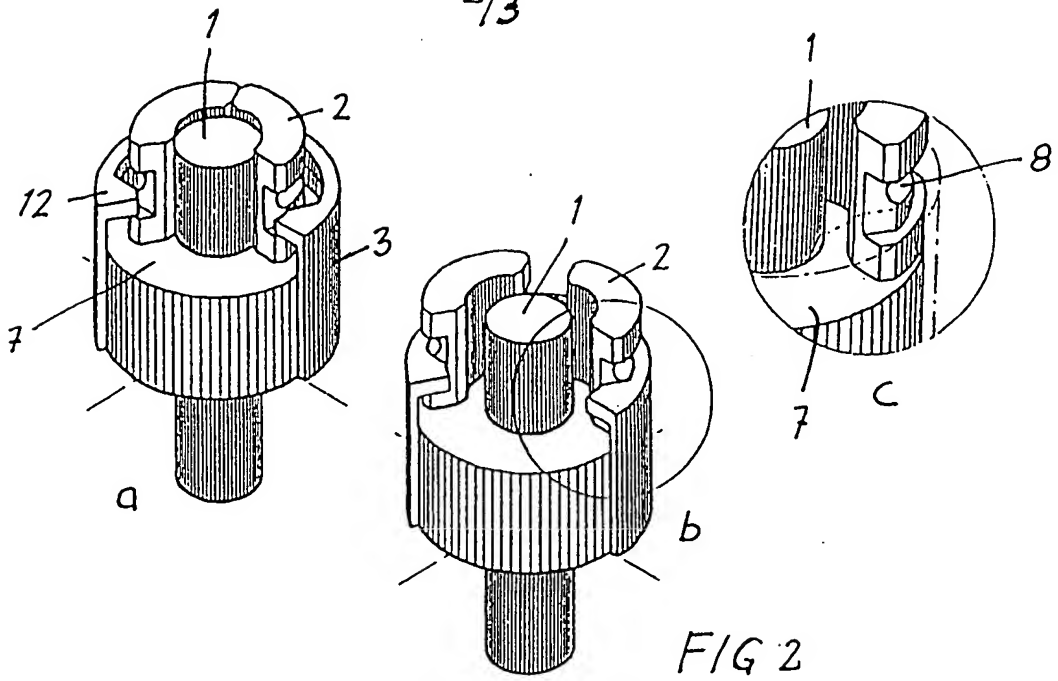

FIG 2

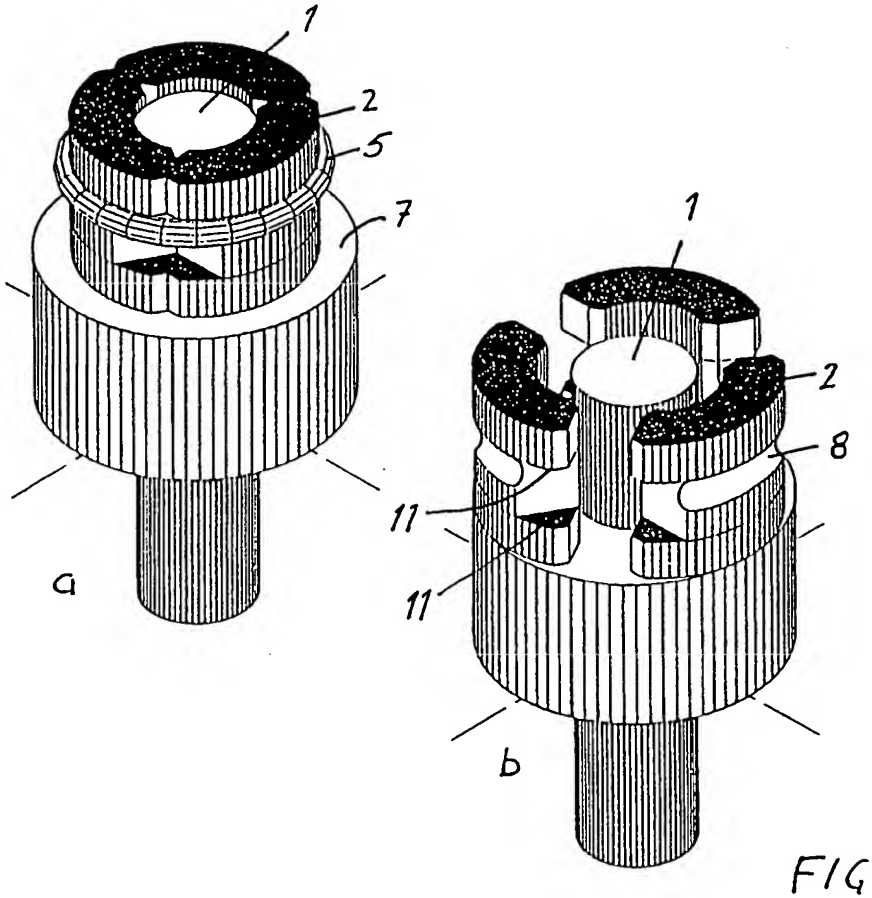

FIG 3

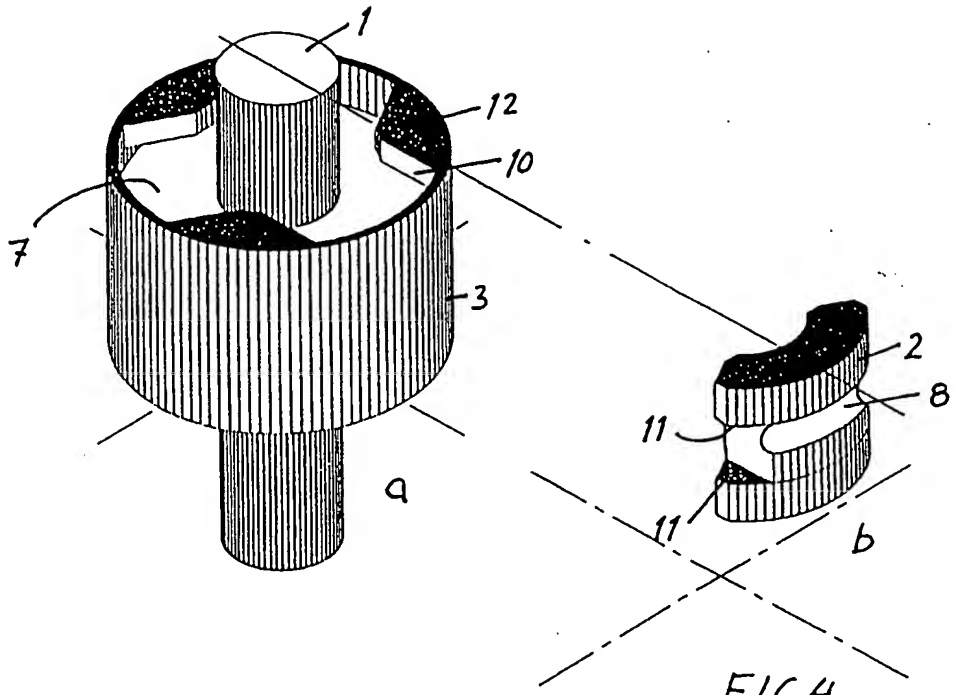

FIG 4

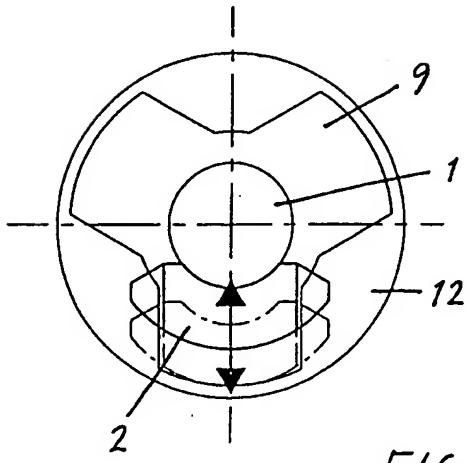

FIG 5